Tektronix®

OFDM
Plug-in Application

Printable Help

077-1348-01

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www.tek.com
077-1348-01

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Supports OFDM Plug-in application Version 3.1.x and above.

Help part number: 076–0409–01

PDF of Help system part number: 077–1348–01

Contacting Tektronix

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

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Welcome

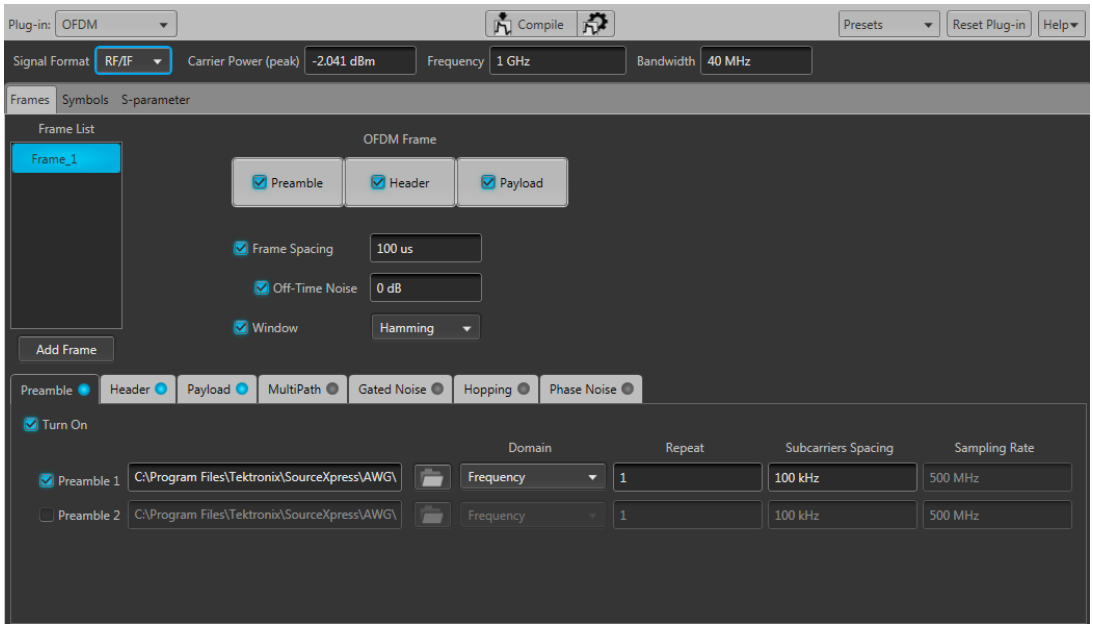
The Orthogonal Frequency Division Multiplexing (OFDM) plug-in is a waveform creation application used to create a number of closely spaced modulated carriers. With this application, you can custom build OFDM frames by defining symbols and the parameters within symbols.

The OFDM plug-in is designed to integrate and operate seamlessly as an enhancement to the following products:

- SourceXpress waveform creation software
- AWG70000 series arbitrary waveform generators
- AWG5200 series arbitrary waveform generators

Once installed, the plug-in becomes available as another waveform plug-in application.

This illustration shows the OFDM plug-in viewed from the SourceXpress application. The plug-in interface is identical whether it is used from SourceXpress or installed on a generator.



Key features

- Configure all parameters of OFDM
- Custom build OFDM frames right from defining the base data, symbols, and frames
- Add Impairments, Phase Noise, and Multi-path

- Define frequency hopping and gated noise
- Support for a variety of sub-carrier modulation (BPSK, QPSK, 8-PSK, and QAM (8, 16, 32, 64, 128, 256, 512, 1024)

Documentation

In addition to this application Help system, the following documentation is available for the software.

All documentation is available on the Tektronix Web site (www.tek.com/manual/downloads).

To read about	Use these documents
OFDM plug-in operation and user interface help	Access the plug-in application help from the plug-in Help menu for information on all controls and elements on screen. The OFDM plug-in help system is also available in PDF format located in the program's installation folder and also available on the Tektronix web site.
OFDM plug-in programmer commands	Access the plug-in programmer manual for the syntax of remote commands specific to the plug-in. This is available on the Tektronix web site.
SourceXpress operation and user interface help	Access the SourceXpress application help from the Help menu for information on all controls and elements on screen. The SourceXpress help system is also available in PDF format, available on the Tektronix web site.
SourceXpress programmer commands	Access the SourceXpress programmer manual for the syntax of remote commands. This document is available in PDF format located in the program's installation folder and also available on the Tektronix web site.
Connected instrument operation and user interface help (such as an AWG70000 series generator)	For operation and interface help of a connected instrument, refer to the instrument's documentation. This is available with the instrument or on the Tektronix web site.
Connected instrument programmer commands (such as an AWG70000 series generator)	For programming information of a connected instrument, refer to the instrument's documentation. This is available with the instrument or on the Tektronix web site.

Support information

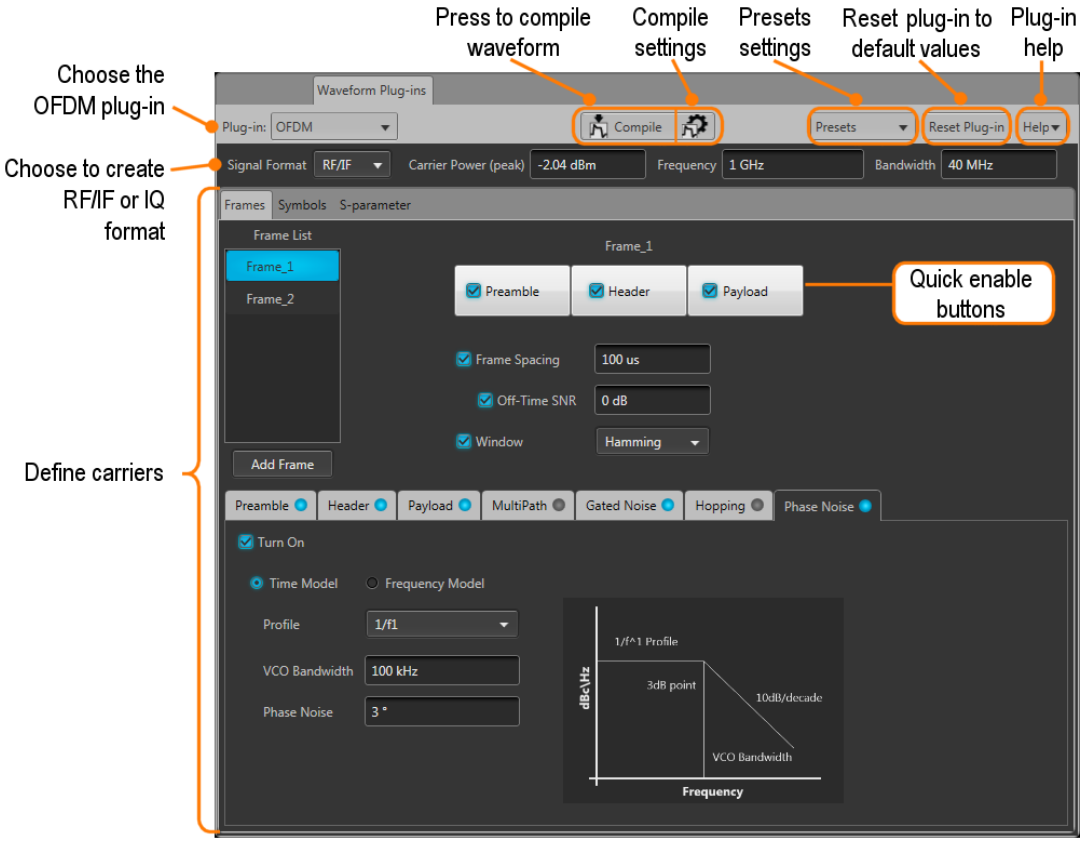
Tektronix offers the following services in support of their products:

- **Technical Support**. For application-related questions about a Tektronix product, contact us by telephone or email).
- **Service Support**. For service-related questions about a Tektronix product, contact us by telephone or email).

Tektronix also offers extended warranty and calibration programs as options on many products. Contact your local Tektronix distributor or sales office.

Elements of the display

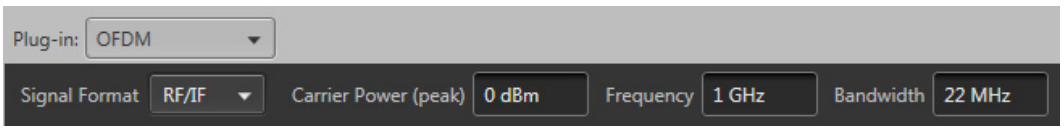
The main areas of the application window are shown in the following figure.



Signal format selection

The Signal Format selection lets you choose the carrier type, either for RF signals (RF/IF) or baseband signals (IQ).

See the Basic setup (see page 13) section for additional details.



Plug-in selection

Use the Plug-in pull-down menu to select the OFDM signal modulation plug-in application. The plug-in pull-down menu varies depending on the installed applications.

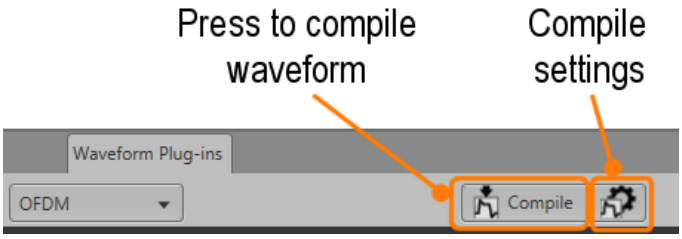
NOTE. *The OFDM signal modulation plug-in requires a license to create waveforms.*

Refer to Licensing (see page 39).

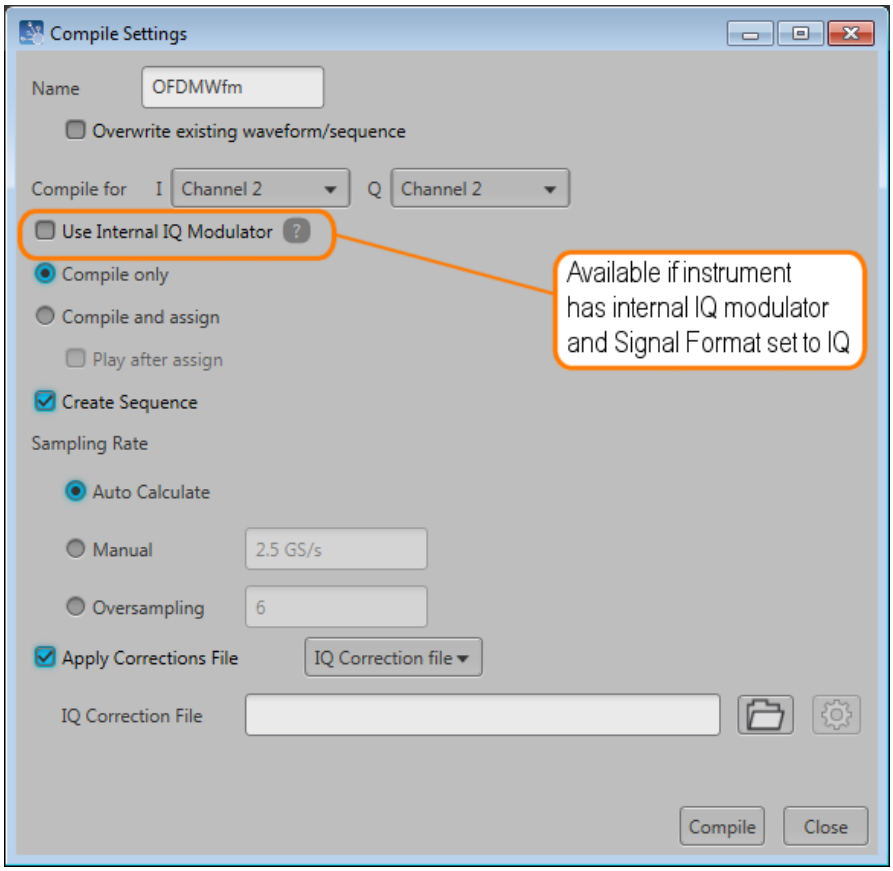
Compile button

Use the Compile button to create the waveforms and place the waveforms into the Waveforms list of the host generator.

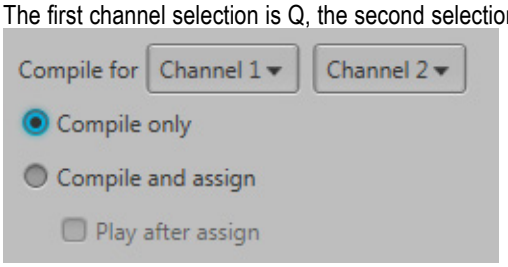
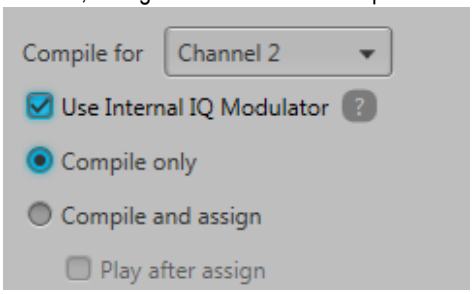
Use the Compile settings (see page 7) button to edit the compilation settings.

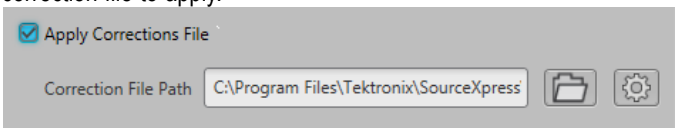
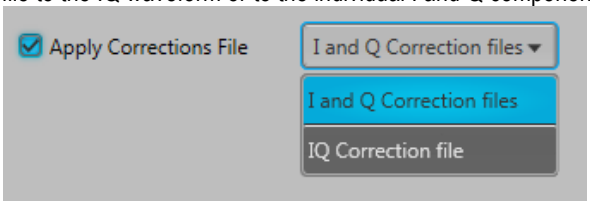
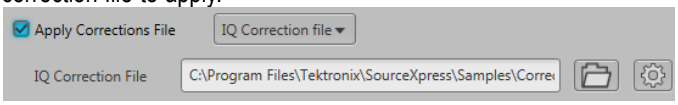
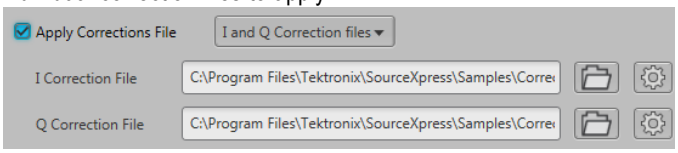


Compile settings



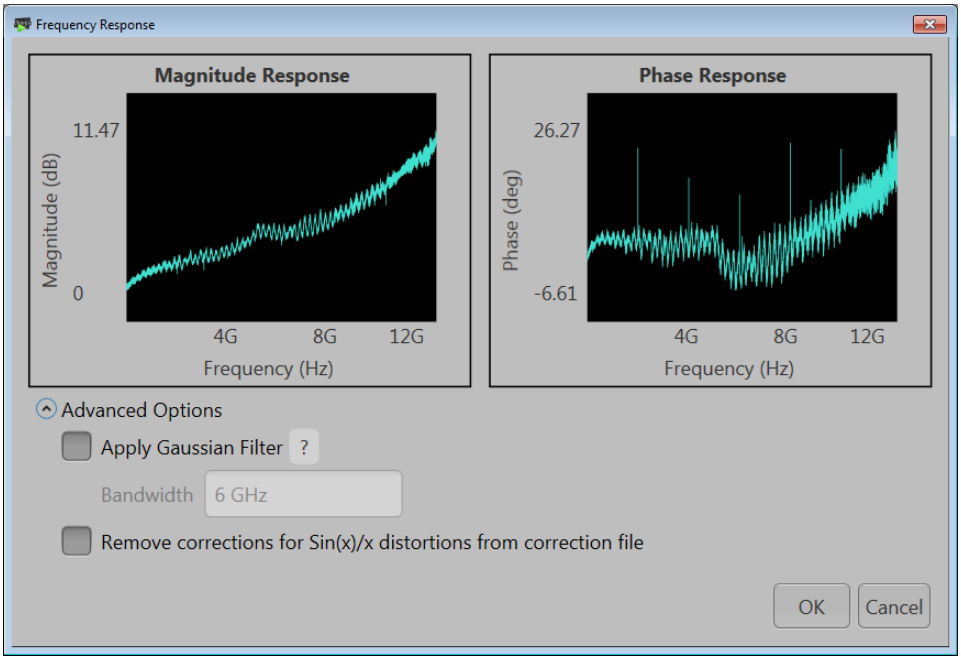
Item	Description
Name	The application provides a base name for compiled waveforms. You can edit the field with a name of your choice. The waveform is added to the Waveforms list. If the name already exists, the name is incremented with a numerical value (unless the overwrite option is selected). The Reset Plug-in button resets the Name field to the default name.
Overwrite existing waveform/sequence	If checked, a waveform/sequence with the same name (in the waveforms or sequence list) is overwritten with no warnings.

Item	Description
Compile for	**Signal Format = RF/IF** Choose the channel to associate with the compiled waveform. The selected channel is also used to define the amplitude ranges. The available channels is dependent on the generator model. **Signal Format = IQ** When compiling IQ signals, you are presented with two channel selections. The first channel selection is Q, the second selection is I.  If the generator has IQ modulator capabilities (digital up converter) and the IQ modulator is enabled, a single channel selection is presented and complex IQ waveform is created. 
Use Internal IQ Modulator	If checked, a complex IQ Waveform is created which can be used with the internal IQ modulator. Sampling Rate and interpolation rates will be calculated based on the Baseband parameters. This setting is not shown if the generator does not have an internal IQ modulator.
Compile only	The compiled waveforms are simply entered into the Waveforms list and Sequences list.
Compile and assign	The compiled waveforms are entered into the Waveforms list and automatically assigned to a selected channel.
Play after assign	If checked, the waveform starts to play out immediately after compiling. The instrument's sample rate and amplitude will change based on the compiled waveform's properties.
Create sequence	If checked, a sequence with waveforms will be created after compilation.
Sampling Rate	
Auto Calculate	This is the default method to set the sampling rate. The application creates a sampling rate based on the settings chosen for the waveform.
Manual	Select to enter a specific sampling rate.
Oversampling	Select to increase the apparent sampling rate. The Sampling Rate is calculated by multiplying Oversampling with the maximum frequency of the signal to be generated.

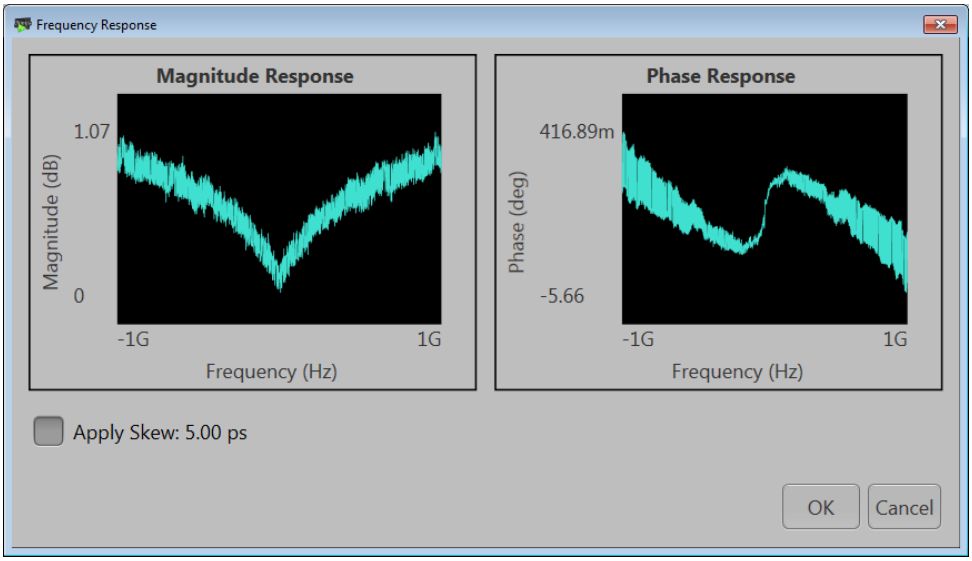
Item	Description
Apply Corrections File	Check the box to apply a correction file directly to the waveform when compiling. The correction file dialog changes depending on the Signal Format, RF/IF or IQ.
RF/IF Signal Format	With the signal format set to RF/IF, the correction file dialog lets you select a single correction file to apply.  Use the browse folder icon to navigate to a saved correction file. Once a valid file path is entered, the Correction Settings icon is enabled. Select to display the Frequency Response screen.
IQ Signal Format	With the signal format set to IQ, the correction file dialog allows you to apply a correction file to the IQ waveform or to the individual I and Q components of the waveform.  When applying an IQ correction file, the correction file dialog lets you select a single correction file to apply.  When applying an I and Q correction files, the correction file dialog lets you select individual correction files to apply.  Use the browse folder icon to navigate to a saved correction file. Once a valid file path is entered, the Correction Settings icon is enabled. Select to display the Frequency Response screen.
Compile	Compiles the waveform.

Correction file frequency response

If applying an RF correction file, the Frequency Response screen shows plot information and provides Advanced options to apply a Gaussian filter and remove Sin(x)/x distortions.



If applying an I/Q correction file (to a pair of I and Q waveforms), the Frequency Response screen shows plot information and provides Advanced options to apply a skew.



Reset Plug-in button

Returns all plug-in settings to their default values.

Presets button

The Presets button provides access to the following menu of preset files that you can use to create WiFi and WiMax signals according to standards. To use a preset, select the desired standard and then click the Compile button.

For WiMedia standards, please refer to the MultiBand OFDM Physical Layer Specification Version 1.2 by WiMedia Alliance.

Item	Standard
WiFi	802.11a 36 Mbit/s QAM16
WiMax	802.16 2004 Downlink 5 MHz
	802.16 2004 Downlink 10 MHz
	802.16 2004 Downlink 20 MHz

Help button

The Help button provides links to additional product help and documentation.

Item	Description
User manual	Opens the plug-in help system.
About ...	Provides you with information about your plug-in application. This information is helpful when contacting Tektronix about your application.

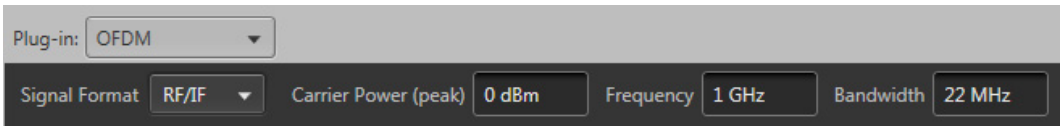
Basic setup

Signal format selection

The Signal Format selection lets you choose the signal format type, either as RF signals (RF/IF) or baseband signals (IQ).

RF/IF

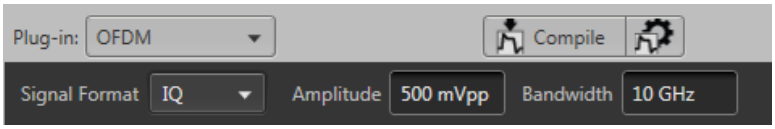
When set to RF/IF, the dialog screen changes to set the basic parameters for the RF/IF carrier. A single waveform is created when compiling an RF/IF waveform.



Item	Description
Carrier Power (peak)	Enter the power of the carrier in dBm. The range is –8.062 dBm to –2.041 dBm.
Frequency	Enter the frequency of the carrier in Hz. The range is dependent on the instrument.
Bandwidth	Enter the bandwidth of the carrier in Hz. The range is 100 kHz to 10 GHz.

IQ

When set to IQ, the dialog screen changes to set the basic parameters for the IQ carrier. Two waveforms are created when compiling IQ waveforms.

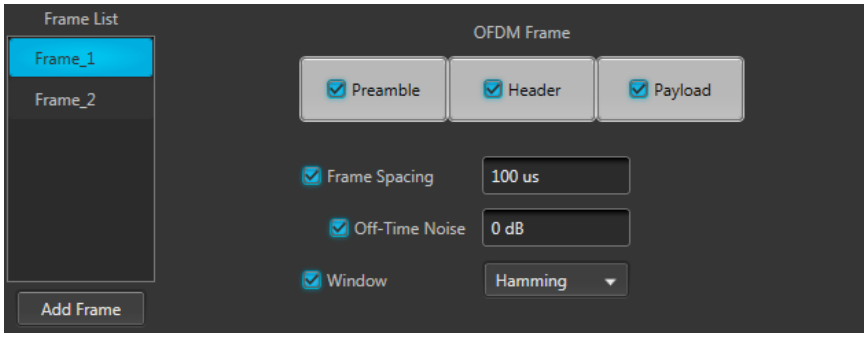


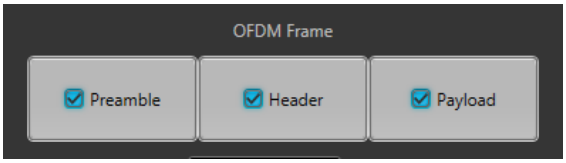
Item	Description
Amplitude	Enter the amplitude of the carrier in peak-to-peak volts. The range is dependent on the instrument.
Bandwidth	Enter the bandwidth of the carrier in Hz. The range is 100 kHz to 10 GHz.

Frame settings

The Frames tab contains the basic frame settings. You can define up to 100 frames.

All frame settings are unique for each frame.



Item	Description
Frame List	The Frames dialog area lists all the currently defined frames. You can define (add) up to 100 frames.
Add Frame button	The Add Frame button inserts a new frame to the end of the list. The added frames are initially set to Frame_#, where the # is incremented for each added frame. To edit the frame name, double left-click on the name to enter the editing mode. Once in the editing mode, you can also right-click to display the Cut, Copy, and Paste options. To remove a frame, select the frame and right-click to display the Remove option.
OFDM Frame quick access buttons	 These buttons allow you to easily enable or disable the Preamble, Header, and Payload configurations for each frame. Initially, any new frame will have the Preamble, Header, and Payload enabled by default. At least one must be enabled to compile a waveform.
Frame Spacing	Specify the spacing between the frame in seconds. An off-time waveform is automatically created in addition to the carrier waveform during compile. Enabling Frame Spacing also enables the Off-Time Noise setting.
Off-Time Noise	Specify noise in dB for the off-time duration. A Noisy off-time waveform is created when this is enabled. This is available only when using Frame Spacing.
Window	Select the overlap window type from the following: None, Triangular, Kaiser, Hanning, Hamming, and Blackman. This is used to shape the spectrum of header and payload symbols.

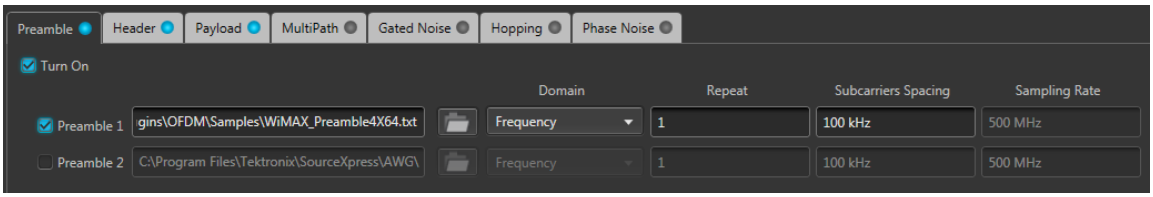
The secondary tabs on the Frames tab allow you to continue setting carrier parameters that are unique to each frame.

See the following topics.

- Preamble tab (see page 16)
- Header tab (see page 17)
- Payload tab (see page 17)
- Multipath tab (see page 18)
- Gated Noise tab (see page 19)
- Hopping tab (see page 19)
- Phase Noise tab (see page 20)

Preamble tab

Click Turn On to enable the frame preamble. This can also be enabled and disabled from the OFDM Frame quick set buttons.



Enable one (or both) of the Preamble selections to define the path to a saved preamble file. You can enter the path directly or use the folder icon to navigate to your saved file.

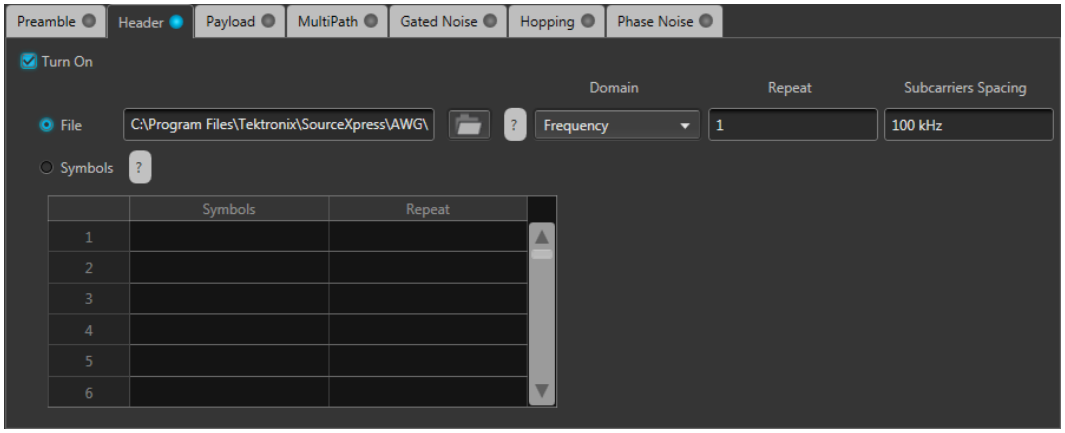
For each frame, you can use either or both preamble files. Based on the different standard needs, there can be multiple preamble requirements. Two preambles are supported in the OFDM plug-in application.

Item	Description
Domain	Specify data in Frequency domain or Time domain.
Frequency	Preamble data can be specified in the Frequency domain.
Time	Preamble data can be specified in the Time domain.
Repeat	Specify the repeat value, which defines the number of times Preamble is repeated.

Item	Description
Subcarriers Spacing	Subcarrier spacing defines the separation of each carrier in the frequency domain description of the Preamble data.
Sampling Rate	Specify the sampling rate for the data in the Preamble file.

Header tab

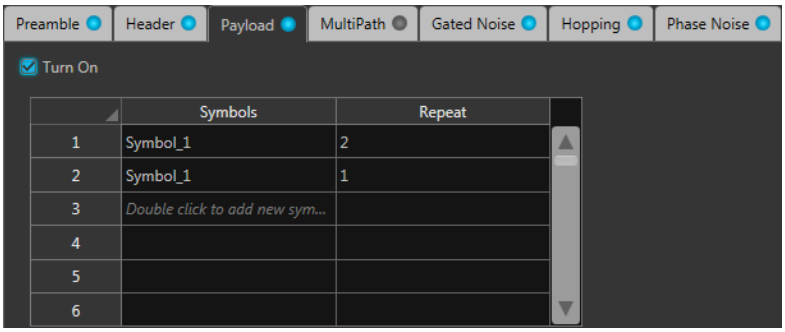
Click Turn On to enable the header. This is can also enabled and disabled from the OFDM Frame quick set buttons.



Item	Description
File	Select file to use a predefined header file.
Domain	Chose how the header file is structured in the Frequency domain or Time domain. Two-sided spectrum is assumed for Frequency domain.
Repeat	Specify the repeat value, which defines the number of times Header is repeated.
Subcarriers Spacing	Subcarrier spacing defines the separation of each carrier in the frequency domain description of the Header data.
Sampling Rate	Specify the sampling rate for the data in the Header file.
Symbols	Select Symbols to insert defined symbols into the table.
Symbols	Select a row to insert a user defined symbol. A dialog box is presented to allow you the select the symbol to insert. The symbols must first be defined in the Symbols tab (see page 23).
Repeat	Specify the repeat value, which defines the number of times the symbol is repeated.

Payload tab

Click Turn On to enable the payload. This is can also enabled and disabled from the OFDM Frame quick set buttons.



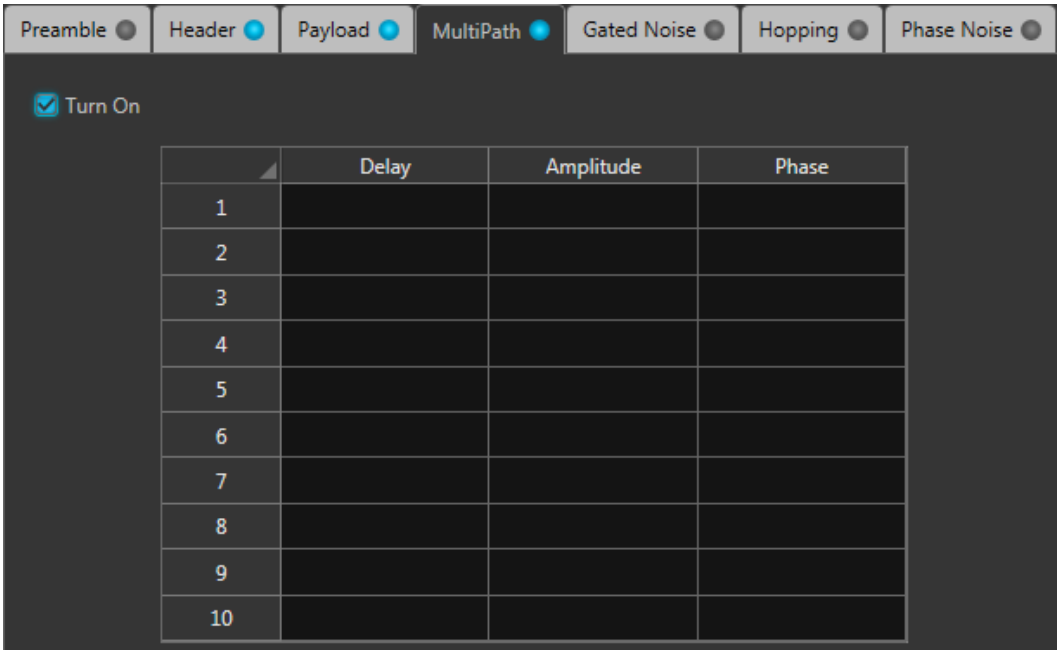
Item	Description
Symbols	Select a row to insert a user defined symbol. A dialog box is presented to allow you the select the symbol to insert. The symbols must first be defined in the Symbols tab (see page 23).
Repeat	Specify the repeat value, which defines the number of times the symbol is repeated.

Multipath tab

Click Turn On to enable multipath.

Multipath can be used to simulate the reflected signals which arrive with different delays.

You can define a maximum of ten multipaths, setting the delay, amplitude and phase values for each path. No two paths can have the same delay value.



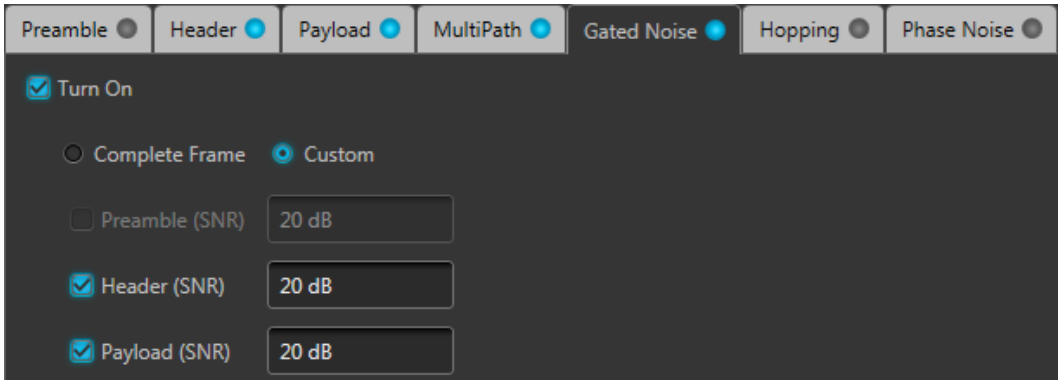
Item	Description
Delay	Enter the delay in seconds from the reference path. The delay must be positive. Delay values cannot be repeated.
Amplitude	Enter the amplitude in dB from the reference path. The amplitude for each path can be set to zero dB or reduced.
Phase	Enter the phase in degrees from the reference path. The phase can be positive or negative.

Gated Noise tab

Click Turn On to enable gated noise.

When Complete Frame is selected, the signal to noise level (SNR) is set equally across the entire frame (Preamble, Header, and Payloade).

When Custom is selected, you can add gated noise to each component of the frame and define the SNR for each component.

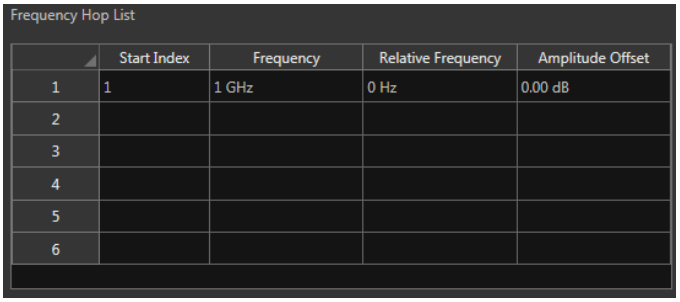
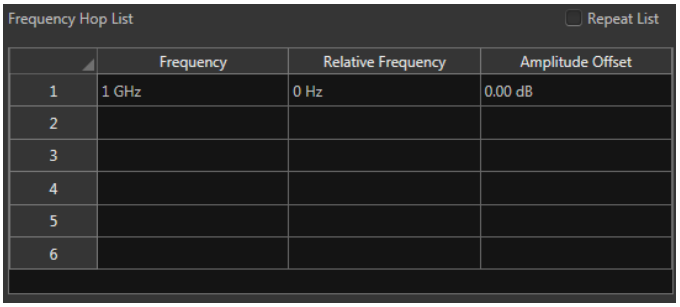


Hopping tab

Click Turn On to enable hopping.

Hopping allows you to add frequency and amplitude hopping for a selected carrier.

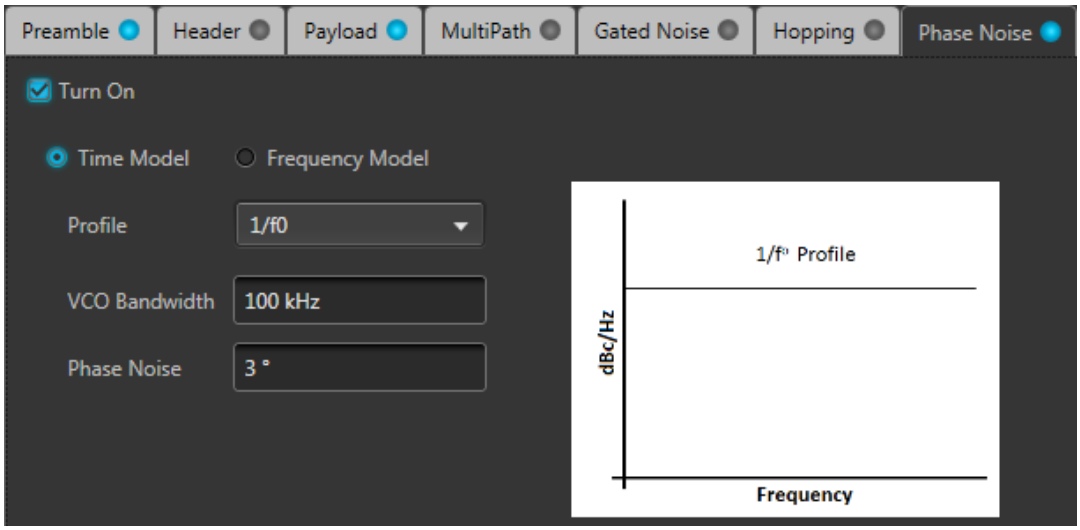
Frequency hopping can be used to create frequency agile waveforms. Frequency hopping is used in electronic counter measures by rapidly switching the frequency of the transmitted energy, and receiving only that frequency during the receiving time window.

Item	Description
Hop Time	Hopping times are based on the Frequency Hop List. Select the method to define the Hop Time: Symbol Start Index Symbols Per Hop
Symbol Start Index	Defines the index the specific hop starts. Each hop must contain a unique start index.
	
Symbols Per Hop	
Symbols per Hop field	Symbols per Hop determines how many Symbols occur between each Hop. The value applies to the entire hop pattern. Range: 1 to 5000000.
	 Frequency (not available for IQ signal format) Relative Frequency Amplitude
Repeat List	When the Repeat List is enabled, the relative frequency and amplitude offset values are repeated.

Phase Noise tab

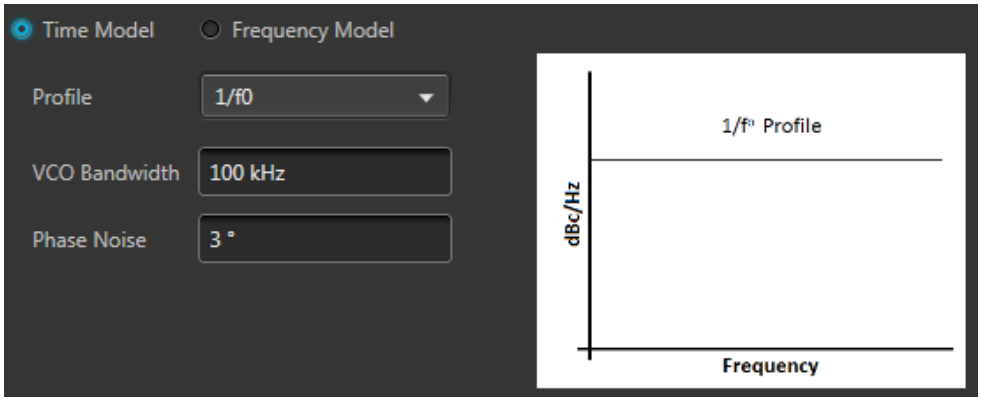
Click Turn On to enable phase noise.

Choose to enter the phase noise description using Time Model or Frequency Model. You can control the phase noise property in terms of its magnitude and spectral content using either one of these models.



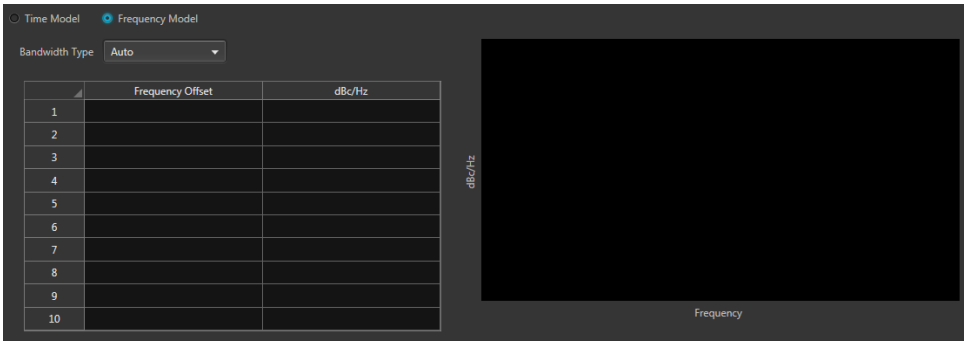
Item	Description
Profile	Choose one of the phase noise profiles from the pull-down list. $1/f^0$ $1/f^1$ $1/f^2$ $1/f^4$
VCO Bandwidth	Specify the bandwidth (VCO cutoff) for the selected profile. This field is not available if the selected profile is 1/f0.
Phase Noise	Specify the phase in degrees for the selected profile.

Time Model



Item	Description
Profile	1/f0 1/f2 1/f3 1/f4
VCO Bandwidth	Specify the bandwidth (VCO cutoff) for the selected profile. This field is not available if the selected profile is 1/f0.
Phase Noise	Specify the phase in degrees for the selected profile.

Frequency Model



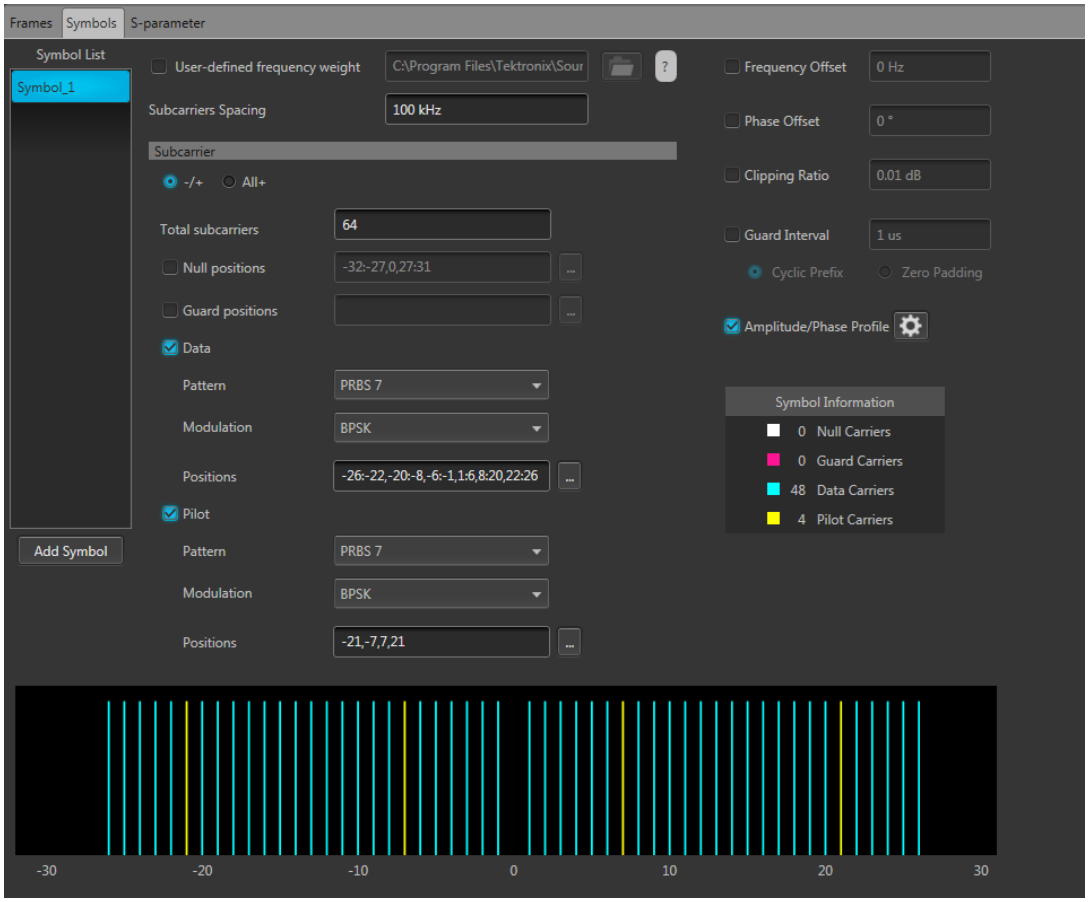
Item	Description
Bandwidth Type	Select either Auto, Frequency, or Level as the Bandwidth Type.
Level	Specify the cut-off level for bandwidth consideration.
Frequency	Specify the frequency to be considered as the bandwidth for phase noise power spectral density.
Auto	In this mode, bandwidth is selected based on the system sampling rate and a predefined power spectral density level of -180 dBc/Hz.

Symbols tab

Use the Symbols tab to create and define symbols. Each symbol is unique with different settings.

At least one symbol is present in the symbol tab. Click Add to add a symbol to the table. To rename a symbol, select the symbol, double-click it and type a name.

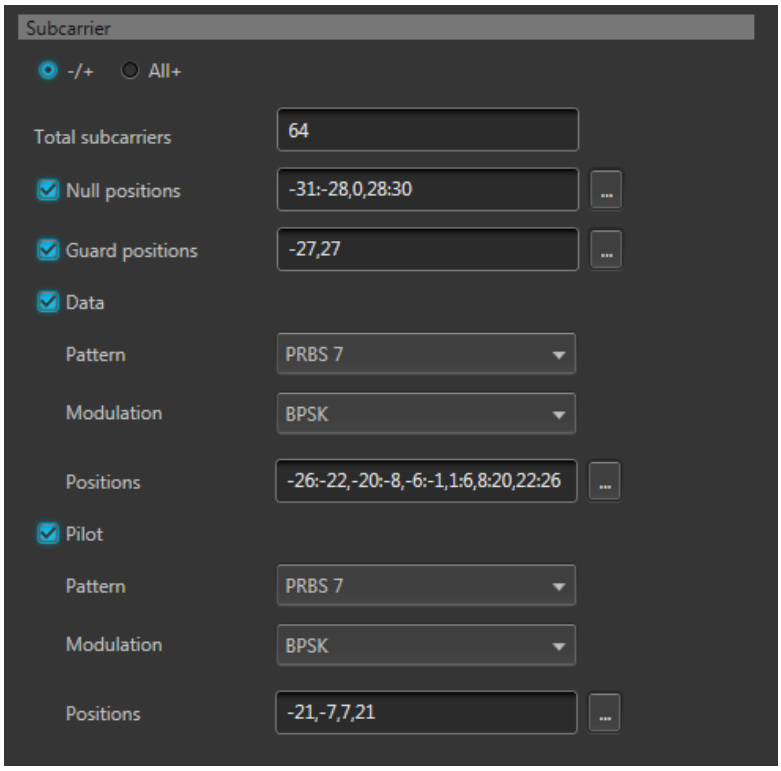
The symbols defined here are then available for selection in the Frames Payload tab (see page 17).



Item	Description
User-defined frequency weight	Specify the file from which to load symbol data. You still have to specify the Subcarrier spacing. Additionally, you can add Frequency Offset, Phase Offset, Clipping Ratio, Guard Interval, and an Amplitude/Phase Profile to the symbol. The Subcarrier parameter selections are disabled when using a user defined file. A two-sided spectrum is assumed for a frequency domain symbol description.
Subcarriers Spacing	Enter the frequency interval between carriers. The maximum value is dependent on carrier bandwidth (BW). Range is from 1 Hz to carrier bandwidth. Min: 1 Hz Max: Carrier BW value
Frequency Offset	If enabled, then specify the frequency offset value for the selected symbol.
Phase Offset	If enabled, then specify the phase offset value for the selected symbol.
Clipping Ratio	If enabled, then specify the Clipping Ratio value for the selected symbol. Clipping Ratio is the Clip power level divided by Average Power.
Guard Interval	This is used to reduce inter-symbol interference and reducing fading due to the frequency selective nature of the channels. Cyclic Prefix Zero Padding
Amplitude Phase Profile	Select to turn on the profile. Use the settings icon to display the profile configuration display. See the topic Amplitude Phase Profile (see page 29).
Subcarrier	The subcarrier section is not available when using a user-defined frequency weight. See the Subcarriers (see page 24) for an explanation of the settings.

Subcarriers for symbols

The subcarrier section is not available when using a user-defined frequency weight.



Item	Description
–/+	Select –/+ to show both the negative and positive subcarriers in the display graph.
All+	Select All+ to only show the positive subcarriers in the display graph.
Total subcarriers	Enter the number of carriers for each symbol. A minimum of two carriers is required. A maximum of 1,048,576 carries is allowed but the number must be a multiple of two.
Null positions	Enable the Null positions if you want to specify certain subcarriers as null carriers, then specify the positions. Double click inside the positions box to enter values directly. Click the ... icon to display a text entry screen for easier entry. Null carriers are colored white in the display graph. See Defining subcarrier positions (see page 28) for information on how to properly format the positions.

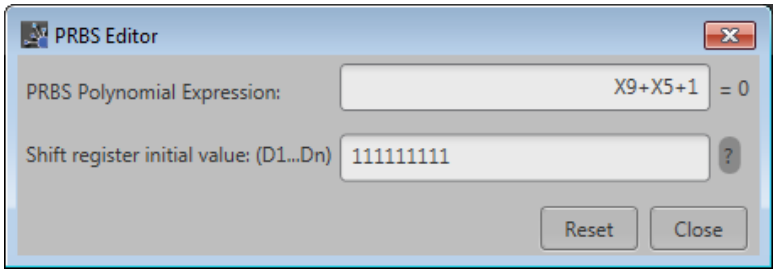
Item	Description
Guard positions	Enable Guard positions if you want to specify certain subcarriers as guard carriers, then specify the positions. Double click inside the positions box to enter values directly. Click the icon to display a text entry screen for easier entry. Guard carriers are colored fuchsia in the display graph. See Defining subcarrier positions (see page 28) for information on how to properly format the positions.
Data and Pilot subcarriers	Enable Data and Pilot subcarriers to specify these subcarriers. Data carriers are colored blue in the display graph. Pilot carriers are colored yellow in the display graph. Once enabled, you can specify the Pattern, Modulation, and Positions.
Pattern	Data and Pilot subcarriers require a pattern selection. See Defining the Pattern (see page 26).
Modulation	Data and Pilot subcarriers require a modulation selection. See Modulation types (see page 27).
Positions	Data and Pilot subcarriers require that you specify the positions of these carriers. See Defining subcarrier positions (see page 28) for information on how to properly format the positions.

Defining the Pattern

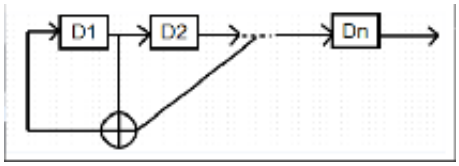
Item	Description
All One	Sends a sequence of binary 1 symbols.
All Zero	Sends a sequence of binary 0 symbols.
File	Select the base data file to be used by entering the path or browsing to the file. The supported format is .txt.
PRBS	Select the PRBS type from the following: 7, 9, 15, 16, 20, 21, 23, 29, 31, and User Defined. To edit the bit sequence, select User Defined. This displays the PRBS Editor icon . Select to display the PRBS Editor (see page 27) dialog screen.
Pattern	Enter a pattern of 0s and 1s up to a maximum of 256 digits in the text field that appears.

PRBS Editor

This dialog box is displayed when clicking PRBS Editor icon when PRBS is set to User Defined for the Data and Pilot pattern type. (Symbols tab).



PRBS sequences are generated by a feedback shift register. The number (#) following PRBS indicates the length of the generating shift register. For instance, a shift register with 16 memory cells is required to generate a PRBS 16 sequence. The pseudo-random sequence of a PRBS generator is determined by the number of registers and the feedback.



Modulation types available

Item	Description
PSK	BPSK, QPSK, 8PSK
QAM	8 QAM, 16 QAM, 32 QAM, 64 QAM, 128 QAM, 256 QAM, 512 QAM, 1024 QAM

Defining subcarrier positions

Null, Guard, Data, and Pilot positions all need to be specified when enabled.

Proper format of the positions must be followed to avoid errors.

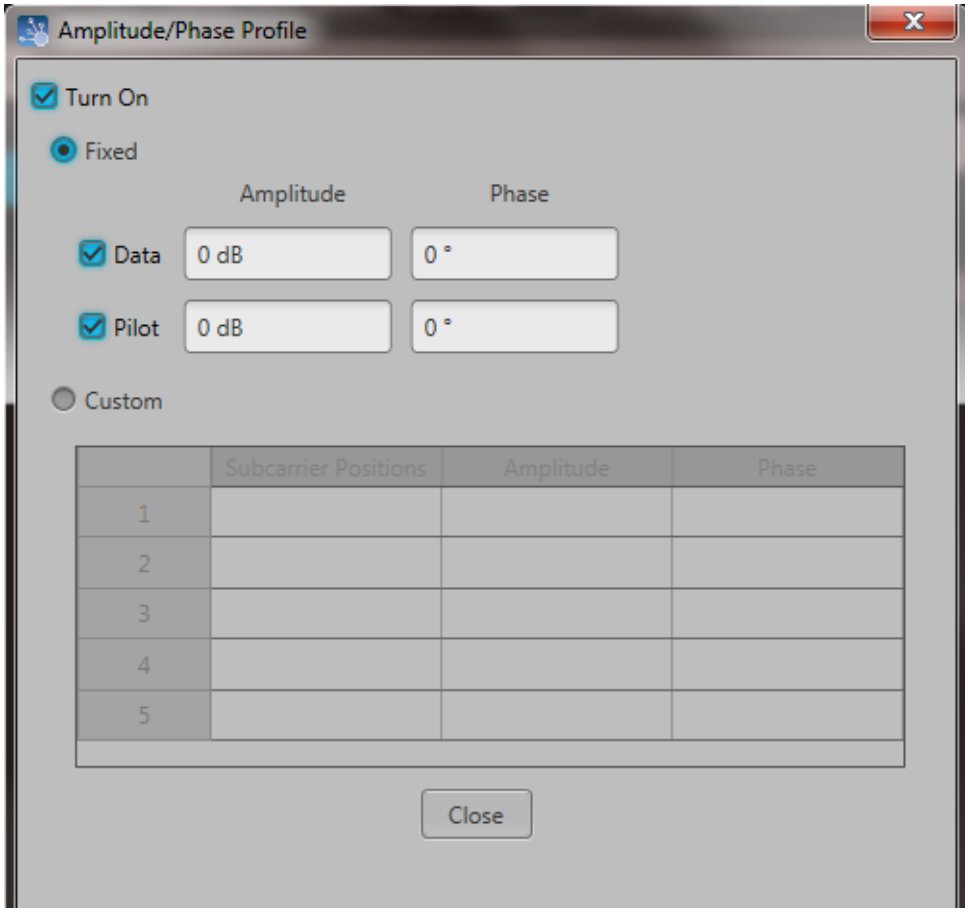
- Double click inside a positions box to enter values directly. Or, click the icon to display a text entry screen for easier entry.
- Separate all positions (or ranges) with a single comma.
- Define a range of positions with the use of colon.

Example:

–22:–19,12,20 selects the four positions from –22 through –19, then positions 12 and 20.

Amplitude Phase Profile

This feature enables the you to selectively apply attenuation and phase rotation on each subcarrier or each type of subcarrier, such as pilot and data subcarriers.



Item	Description
Fixed	Selecting Fixed allows you to enter the amplitude and phase for all data and pilot positions.
Data	The data subcarrier (in the Symbols tab) must be enabled before you can choose to set the data phase profile.
Pilot	The pilot subcarrier (in the Symbols tab) must be enabled before you can choose to set the Pilot phase profile.
Custom	Selecting Custom enables the table editor. With the custom table editor, you can specify the amplitude and phase for any carrier position. See Defining subcarrier positions (see page 28) for information on how to properly format the positions.

S-Parameter license

A license is required to use the S-Parameter feature.

S-Parameters is available when a license is detected by the application. With the license installed on the host PC where SourceXpress is installed, S-Parameters is available regardless of connecting to a virtual generator or a real instrument.

Refer to Licensing (see page 39) for information about obtaining a license file.

S-Parameter

Select Turn on to enable adding S-Parameters to the compiled waveforms.

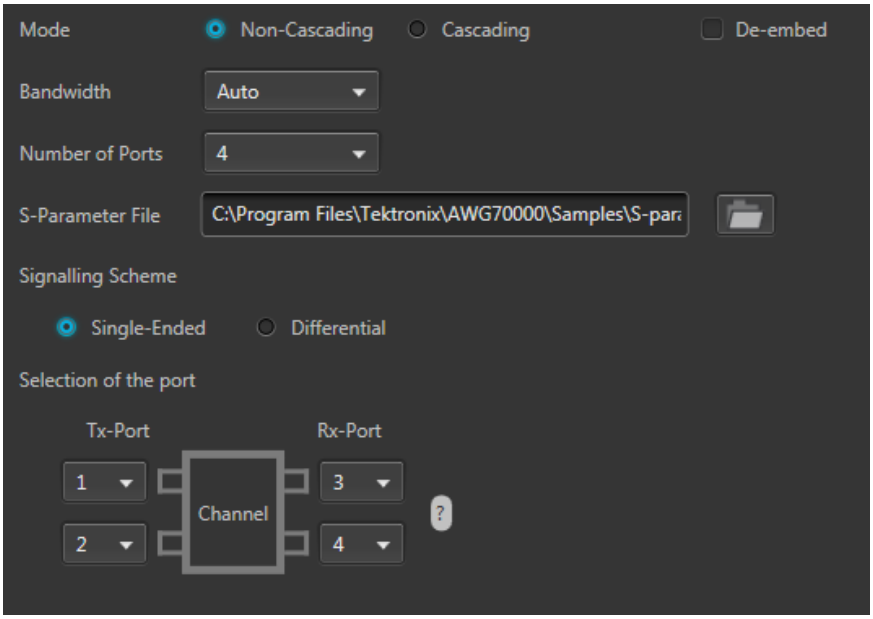
S-Parameter parameters

S-Parameters can be applied to the RF/IF waveform or to the I and Q data, depending on the selected Signal Format. All S-Parameter features apply whether the Signal Format is set to RF/IF or IQ. The only exception is that an additional control is available for the IQ signal format to choose how the S-Parameters are applied to the I and Q components. They can be applied to the individual I and Q components or to the same S-Parameters can be applied to both I and Q.

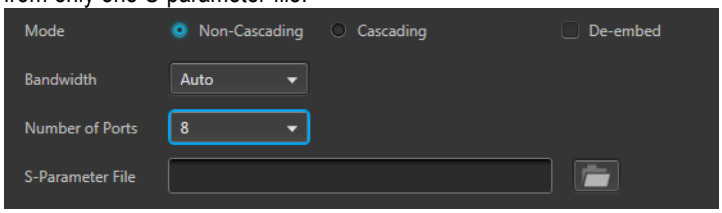
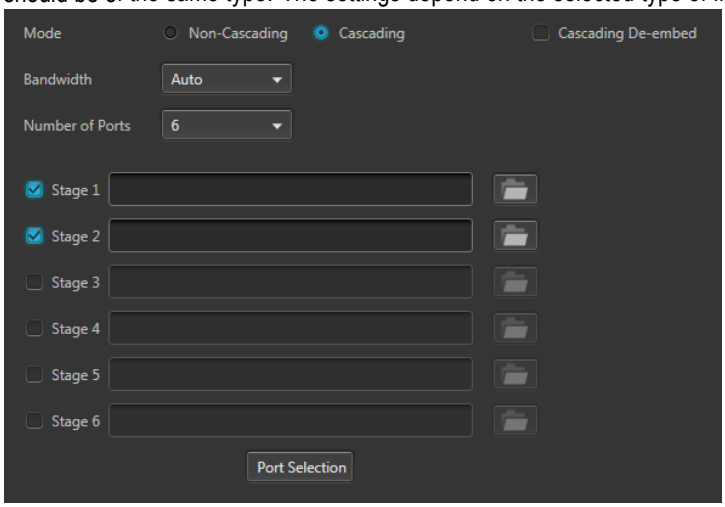
Below is a sample S-Parameter dialog screen with the Number of Ports set to 4 for an RF/IF . The dialog screen changes to accommodate the Number of Ports selected.

The available S-Parameter settings are identical regardless of the selected waveform.

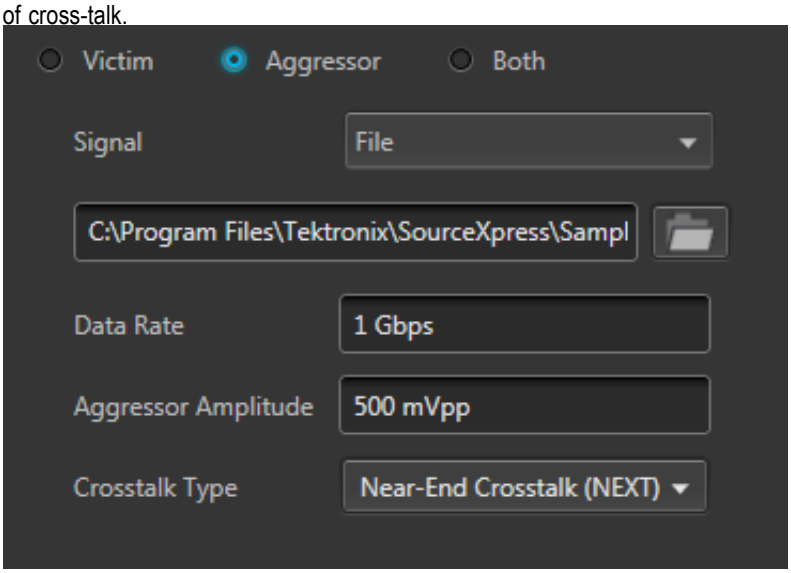
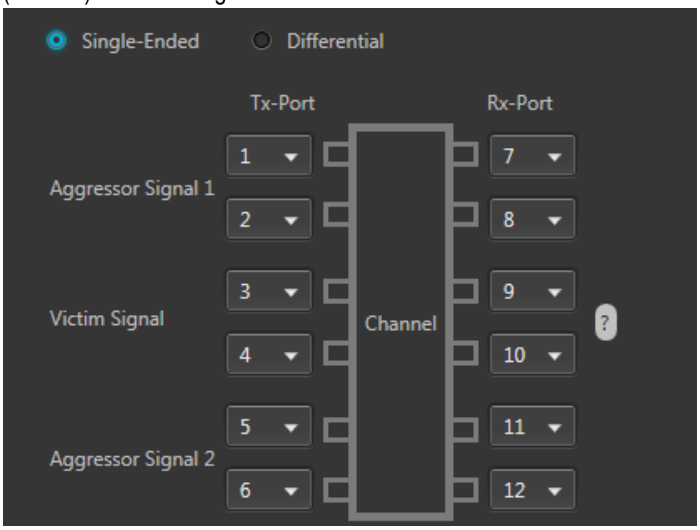
The information provided for S-Parameters applies to both the Non-Cascading and Cascading modes.



Item	Description
S-Parameter settings for (Only available when IQ is the selected Signal Format.)	Select I or Q to apply the S-Parameters to just that selection.
Use same settings for I and Q (Only available when IQ is the selected Signal Format.)	Check this box to apply the same S-Parameters to both I and Q. ⚠ ***CAUTION.*** *When you select this setting, the Q parameters are instantly replaced with the I parameters.*

Item	Description
Mode	Select Non-Cascading or Cascading S-parameter mode. In the Non-Cascading mode, you apply S-parameter characteristics on the signal from only one S-parameter file.  In the Cascading mode, you can cascade up to six S-parameter files in Stages and apply the characteristics on the signal. You can select the files to apply by turning on or turning off the corresponding Stages shown in the display. All the selected files should be of the same type. The settings depend on the selected type of file.  The files supported are s1p, s2p, s4p, s6p, s8p, and s12p.
De-embed (Non-Cascading mode) Cascading De-embed (Cascading mode)	Check the box to invert the S-Parameters from the signal. This removes the effects of the component (for which the S-Parameters were created) from the signal path.
Bandwidth	Auto – The bandwidth is defined at the point where the signal rolls off to -60 dB. If this results in a bandwidth greater than the instrument supports, the bandwidth is set to ½ of the waveform's sample rate (i.e. Nyquist Frequency). Full Bandwidth – The bandwidth is set to ½ of the waveform's sample rate (i.e. Nyquist Frequency). Manual – The bandwidth can set by the user from 1 Hz to ½ of the maximum sample rate of the instrument. If the set Bandwidth is greater than the Nyquist (Sample rate of the waveform/2), then the software limits the bandwidth to ½ of the waveform's sample rate. A warning message is provided.

Item	Description
Number of Ports	Choose the number of ports. The port matrixes supported are 1, 2, 4, 6, 8, and 12. The number of ports selected determines: • The type of S-Parameter file to apply • The Signaling Scheme choice • The port matrixes available
S-Parameter File	Navigate to the Touchstone file to apply to the signal. The type of Touchstone files that you are able to open is dependent on the number of ports selected. For instance, only .s4p files can be opened if the Number of Ports is set to 4. The files supported are s1p, s2p, s4p, s6p, s8p, and s12p.
Signaling Scheme (Only for 4, 8, and 12 ports)	Single-Ended: If the data is single-ended, you must map the port numbers as used in the file to physical locations in your link. Differential: If the data is differential, you must select the data layout in the file.
Selection of the port (Only for 2, 4, and 6 ports)	Use the diagrams to map the ports for the transmitter ports (Tx-Port) and the receiver ports (Rx-Port). When choosing the number of Ports, you are presented with an active diagram of the ports. The diagram presented reflects the Number of Ports selected and the Signaling Scheme (if appropriate for the ports selected).

Item	Description
Victim	Victim: The default setting with no cross-talk effects.
Aggressor and Both (Only for 8 and 12 ports)	Aggressor: Select this to activate aggressor signal parameters, adding the effect of cross-talk. 
Port selection	This interactive area is available only when Number of Ports selection 2, 4, or 6. You can select values for the transmitter ports (Tx-Port) and the receiver ports (Rx-Port) for each stage. 

S-Parameter file descriptions

1-port

Files with one port of data contain only one S-parameter file (s1p) so they do not require any further input.

2-port

Files with data for two ports contain four S-parameters as a 2x2 matrix. These are Touchstone 2-port files (s2p). A dialog box is created to define the 2-port mapping.

4-Port

Files with data for four ports contain 16 S-parameters as a 4x4 matrix. These are Touchstone 4-port files (s4p). They may contain single-ended or differential data. A dialog box is created to define the 4-port mapping for either single-ended or differential data.

- If the data is single-ended, you must map the port numbers as used in the file to physical locations in your link.

  You can select the port for both transmitter and receiver from the drop-down list. Each drop-down list has ports from 1 to 2.

- If the data is differential, you must select the data layout in the file.

6-port

Files with data for six ports contain 36 S-parameters as a 6x6 matrix. These are Touchstone 6-port files (s6p). A dialog box is created to define the 6-port mapping.

8-Port

Files with data for eight ports contain 64 S-parameters as an 8x8 matrix. These are Touchstone 8-port files (s8p). They may contain single-ended or differential data. A dialog box is created to define the 8-port mapping for either single-ended or differential data.

- If the data is single-ended, you must map the port numbers as used in the file to physical locations in your link.

  You can select the port for both transmitter and receiver from the drop-down list. Each drop-down list has ports from 1 to 4.

- If the data is differential, you must select the data layout in the file.

12-Port

Files with data for 12 ports contain 144 S-parameters as an 12x12 matrix. These are Touchstone 12-port files (s12p). They may contain single-ended or differential data. A dialog box is created to define the 12-port mapping for either single-ended or differential data.

- If the data is single-ended, you must map the port numbers as used in the file to physical locations in your link.

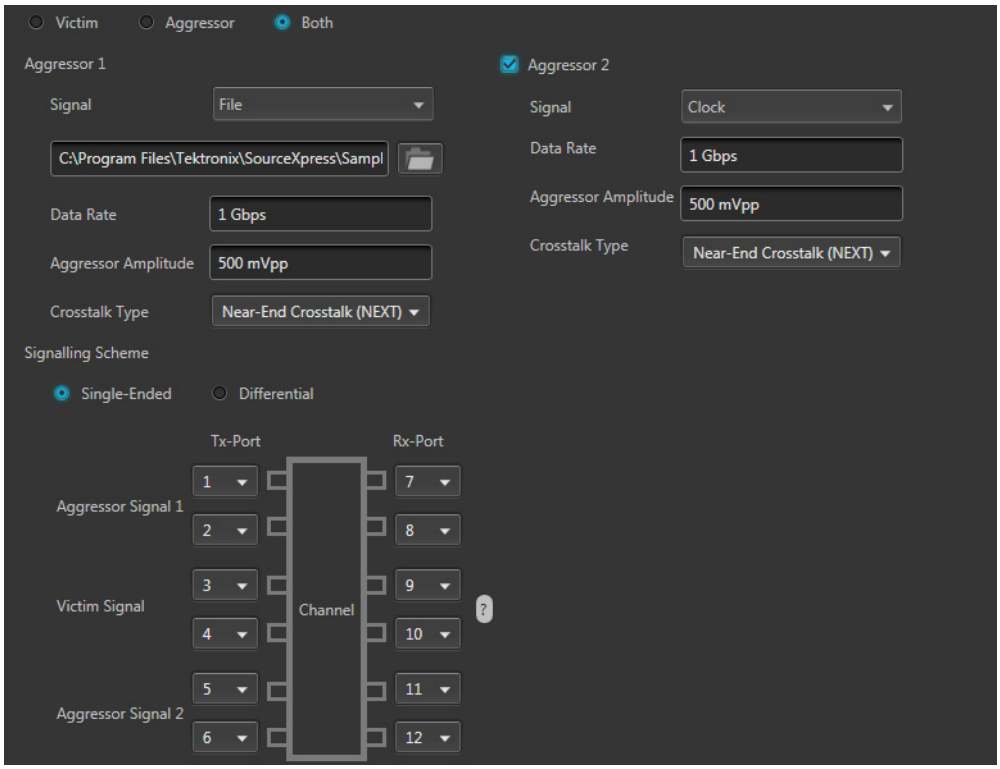
  You can select the port for both transmitter and receiver from the drop-down list. Each drop-down list has ports from 1 to 6.

- If the data is differential, you must select the data layout in the file.

Aggressor signals

8 and 12 port S-parameters allows you to activate aggressor signal parameters and to add the effect of cross-talk. 12 port S-parameters allows 2 Aggressor signal parameters.

Aggressors can be added in either Non-Cascading Mode or Cascading Mode.



The Aggressor signal parameters include:

Item	Description
Signal	Choose the type of aggressor signal with the dropdown list: • Clock: Indicates that the aggressor signal is a clock pattern. • PBRS: Also choose the number of bits • File: Indicates that the aggressor signal is another pattern file. Navigate to the Pattern file • Same as victim: The signal flow of the aggressor is same as the victim.
Data Rate	Specify the data rate (in bps) of the signal. This is not available when the Aggressor signal is set to be the same as the victim.

Item	Description
Aggressor Amplitude	Enter the signal amplitude. This is not available when the Aggressor signal is set to be the same as the victim.
Crosstalk Type	Choose the type of crosstalk of the aggressor signal. • Near-End Crosstalk • Far-End Crosstalk • Both

Licensing

A license is required for this plug-in to become operational. The plug-in must be licensed for use with the host application from where you want to use the plug-in.

For example, to use the plug-in from SourceXpress, SourceXpress must have a license. To use the plug-in from an instrument, the instrument must have a license.

Refer to the application help (such as SourceXpress or the host instrument) for information about obtaining and installing license files.

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